

SACHP0145US (formerly SOU747/4-8US)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of	:	
	:	
Roger Moulton	:	Art Unit: 1625
	:	
Serial No: 10/642,438	:	Examiner: Taylor V. Oh
	:	
Filed: 15 August 2003	:	Confirmation No. 2478

For: **IONIC LIQUIDS CONTAINING A SULFONATE ANION**

DECLARATION OF ROGER D. MOULTON UNDER 37 CFR 1.132

VIA EFS
M/S AMENDMENT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1345

Sir:

I, Roger D. Moulton, declare and say as follows:

(1) I am a co-inventor of the invention disclosed and claimed in U.S. Application No. 10/642,438 ("my present application"). I am an employee of the assignee of the application, SACHEM, Inc.

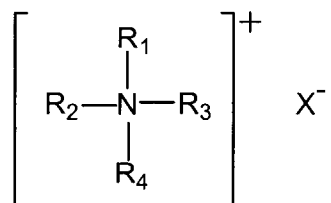
(2) I hold a Ph.D. degree in chemistry, awarded in 1987 by the University of Texas at Austin. My research was in the area of electrochemistry. I have 17 years of industrial experience in chemistry, outside of my academic training.

(3) I have been employed by SACHEM, Inc. for 10 years, in the position of Manager - Electrochemistry. During my employment by SACHEM, Inc., I have worked in the area of ionic liquids for 8 years. I am a named inventor on two U.S. patents relating to ionic liquids (U.S. Patent No. 7,053,232 B2, entitled "Lewis acid ionic liquids" and U.S. Patent No. 6,991,718 B2, entitled "Electrochemical process for producing ionic liquids"). I am a named inventor on a total of 12 U.S. patents.

(4) Based on information provided by my patent attorney, I understand that the claims of my present application have been rejected as unpatentable over U.S. Patent No. 6,306,805 B1, to Bratescu et al. I have reviewed Bratescu et al., and provide the following observations thereon, with particular regard to the differences between the aqueous solutions disclosed therein and the ionic liquids of my present application.

(5) Bratescu et al. discloses aqueous surfactant compositions, more specifically to mixtures of cationic, anionic and bridging surfactants that are useful primarily as shampoos and/or body washes. Bratescu et al. discloses that the surfactant composition includes:

(a) from 0.05 to 5% by weight of a quaternary ammonium compound of the formula:



wherein R_1 , R_2 and R_3 are independently ethyl, methyl or benzyl;

R_4 is an alkyl group having an average of from about 8 to about 18 carbon atoms; and X is halogen, sulfate, methosulfate, ethosulfate, tosylate, acetate, phosphate, nitrate, sulfonate, or carboxylate; and

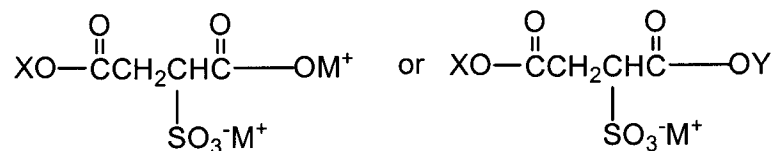
b) an anionic surfactant comprising a mixture of (i) and (ii) as these are defined, e.g., from col. 14, line 64 to col. 15, line 35; and

(c) from about 0.01% to about 15% by weight based on the total weight of the composition a bridging surfactant selected from the group consisting of amine oxides, ethoxamides, and betaines or a mixture thereof; and

(d) water;

wherein the total concentration of combined cationic, anionic, and bridging surfactants ((a), (b) and (c) above) in the composition is from about 3% to about 40% by weight based on the total weight of the composition. (Emphasis added.) As would be understood, this is an aqueous composition.

(6) As disclosed at col. 16, lines 6-9, the surfactant composition of Bratescu et al. may further include from 0.01% to about 20% by weight of an auxiliary anionic surfactant, in addition to the surfactants disclosed above. Bratescu et al. discloses a very large number of possible auxiliary surfactants, from col. 33, line 58 to col. 35, line 63. Of the large number of possible auxiliary surfactants, two specific types of such surfactants are disclosed at col. 35, lines 16-39, as sulfosuccinates including those of the formulae:



where X and Y are the same or different and are selected from the group consisting of R and R(CH₂CH₂O)_x, where x has an average value from about 1 to about 30; R is C₈-C₂₂ alkyl; and M is a counterion.

The sulfosuccinate on the right above is similar to the structure (I) of the presently claimed invention, but the concentrations of the respective compounds are quite different and the solutions containing the respective compounds are quite different. In

addition, other than the fact that the structures are shown, there is nothing in Bratescu et al. to suggest that either of these structures are any more suitable or preferred than any other of the very large number of possible auxiliary surfactants disclosed. In fact, at col. 34, lines 45-50, Bratescu et al. discloses "particularly preferred" auxiliary surfactants are C₈ alkyl sulfates and alkyl ethoxy sulfates. The others are no more than merely "other suitable" auxiliary surfactants.

(7) For the reasons discussed in the following paragraphs, even if one were to select the exact compounds of Bratescu et al. corresponding to the compounds in the claimed ionic liquid of the present invention, one could not obtain an ionic liquid based on or beginning with the teachings of Bratescu et al. The purpose of Bratescu et al. is quite different from the present invention, and there is nothing that would have lead me or any other person of skill in the art from the teachings of Bratescu et al. to the presently claimed invention.

(8) As understood by the person of skill in the art, and set forth in [0006] of the present application, an ionic liquid is a salt comprising a cation and an anion, and is a liquid at or near ambient temperatures. A salt, as known in the art, consists of an ionically and stoichiometrically balanced quantity of anion and cation. Thus, to the extent that the combination of the auxiliary sulfosuccinate anion and the quaternary ammonium (both shown above) constitute a salt, and this salt is considered to correspond to an "ionic liquid", as contended by the patent Examiner, the solution of Bratescu et al. can contain no more than a stoichiometrically equivalent amount of the anion and cation. As disclosed throughout the reference, the aqueous solution of Bratescu et al. can contain no more than 5% by weight of the quaternary ammonium compound. Assuming, for the sake of argument, that one selects the sulfosuccinate structure on the right above out of all the possible auxiliary surfactants disclosed by Bratescu et al., substitutes appropriate R groups for the X and Y components, and combines this with the most preferred quaternary ammonium compound of Bratescu et

al., one would still not obtain the claimed ionic liquid. As noted above, in an ionic liquid, both components must be present in a stoichiometrically equivalent amount. Thus, for example, if the maximum 200 g/l (20% by wt) of the diester sulfosuccinate having the largest R group disclosed by Bratescu et al. (col. 35, line 38), which is C₂₂, is selected, this compound has an empirical formula C₄₈H₉₃O₇S, and a gmw of 813 g/mole, which would make the solution 0.246 M in the sulfosuccinate. If the stoichiometrically equivalent amount of quaternary ammonium is added as the most preferred octyl trimethyl ammonium compound (see col. 26, line 67), this quaternary compound has a gmw = 172. If this is added as a stoichiometrically equivalent amount, $172 \times .246 =$ about 42.3 g of the quaternary ammonium will be added. Thus, the solution will contain a total weight of 242.3 g/l (24.2 wt.%) of the so-called "ionic liquid", which is a far cry from the claimed "greater than 70%" of the ionic liquid of the present invention.

(9) Alternatively, if the smallest R group disclosed by Bratescu et al. for the diester of sulfosuccinate, which is C₈, is selected, and again the maximum 200 g/l (20% by wt) of the C₈ sulfosuccinate is used, this compound has an empirical formula C₂₀H₃₇O₇S, and a gmw of 421 g/mole, which would make the solution 0.475 M in the sulfosuccinate. If the stoichiometrically equivalent amount of another most preferred quaternary ammonium is added, i.e., the dodecyl trimethyl ammonium compound (see col. 27, line 2), this quaternary compound has a gmw = 228. If this is added as a stoichiometrically equivalent amount, $228 \times .475 =$ about 108 g of the quaternary ammonium will be added. Thus, the solution will contain a total weight of 308 g/l (30.8 wt.%) of the so-called "ionic liquid", which is a far cry from the claimed "greater than 70%" of the ionic liquid of the present invention.

(10) If, on the other hand, one were to start with the maximum 5 wt.% quaternary ammonium compound, and were to add a stoichiometrically equivalent amount of the auxiliary surfactant, one would obtain a similar concentration of the "ionic liquid" as above, which is still much lower than that claimed. Thus, if one uses most preferred

octyl trimethyl ammonium compound (see col. 26, line 67), this quaternary compound has a gmw = 172, and a 5% by weight solution (50 g/l) is therefore 0.29 mole/l. If one selects the diester sulfosuccinate having the largest R group disclosed by Bratescu et al. (col. 35, line 38), which is C₂₂, this compound has an empirical formula C₄₈H₉₃O₇S, and a gmw of 813 g/mole, and uses the stoichiometrically equivalent amount, 0.29 mole/l, then one would use $813 \times 0.29 = 236$ g/l of sulfosuccinate plus the 50 g/l of quaternary ammonium = 286 g/l or 28.6 wt.% of the "ionic liquid".

(11) As shown by the foregoing paragraphs (8)-(10), even if the maximum amount of sulfosuccinate and the corresponding amount of quaternary ammonium would be used by one seeking to extend Bratescu et al. to the limits of its disclosure, the resulting solution would still contain only 24-31% of the so-called "ionic liquid". Thus, even if this would be considered an ionic liquid, the concentration is quite different and there is no simple way to modify the teachings of Bratescu et al. to attain a higher concentration of the "ionic liquid".

(12) The so-called "ionic liquid", prepared as in paragraphs (8)-(10), would be sparingly soluble, if at all, in the aqueous medium disclosed in the reference. Therefore, if these amounts of these ingredients were used, in order to obtain a solution, it would be necessary to have high amounts, even the maximum amounts, of the other surfactants present in order to solubilize the "ionic liquid" components contended by the Examiner to be within the scope of the Bratescu et al. teachings.

(13) The resulting aqueous mixtures of surfactants, obtained by following the logic of paragraphs (8)-(10), would not be ionic liquids. These mixtures would instead be nothing more than a mixture of surfactants and water. Most importantly, this mixture would not have the properties of an ionic liquid. The aqueous solution would not be non-reactive, since the bridging surfactants disclosed by Bratescu et al. include a variety of compounds that would be reactive in the various reaction systems in which

ionic liquids are used. The aqueous solution of Bratescu et al. would not be an ionic liquid because its vapor pressure would be much greater than zero. If heated above 100°C, the boiling point of the aqueous component, the water would be lost and the remainder would be a nearly intractable mixture of surfactants, not an ionic liquid. Ionic liquids are typically used a dry substances to remove the pressure/temperature limitations of aqueous solutions and to allow their use as organic solvents at higher temperatures without the need to contain the pressure or be concerned about changes in the composition of the ionic liquid as a volatile component is boiled off. Simply stated, there is no ionic liquid such as that disclosed and claimed in the present application disclosed by Bratescu et al.

(14) Since Bratescu et al. clearly is concerned with the preparation of surfactant compositions for use as shampoos and body washes, there is nothing in the reference that would suggest the extreme modification of increasing the concentration of the quaternary ammonium and the auxiliary anionic surfactant to levels as high as 55 wt.% or 70 wt. %, as now claimed in the present application. In order to make such a modification, one would have to ignore completely the teachings of Bratescu et al. that the quaternary ammonium (a) be limited to a maximum content of 5 wt.% based on the weight of the composition, and that the auxiliary anionic surfactant be limited to a maximum content of 20 wt.% based on the weight of the composition. Bratescu et al. does not even disclose the use of these two selected components in stoichiometrically equivalent amounts. To make such a modification would be to completely change the aqueous solution disclosed by Bratescu et al., and would actually negate the purpose of the reference, which is to provide a composition useful as a shampoo or body wash. There is simply no basis and no reason in Bratescu et al. that any person in the art would make such a dramatic and extensive change in the disclosed composition.

(15) Since Bratescu et al. clearly is concerned with the preparation of surfactant compositions for use as shampoos and body washes, there is nothing in the reference

that would motivate a person to try to use such a composition as an ionic liquid. One would not use a Bratescu-type formulation as though it were ionic liquid, to do organic synthesis, for example. The presence of water would make such a formulation unsuitable for water-sensitive chemistry, which is in common practice in ionic liquids work. For example, one could not use a organometallic catalyst or reagent which would decompose in water. Also the physical properties of aqueous formulations such as those of Bratescu et al., are very close to water, whereas neat ionic liquids have much higher heat capacity, viscosity, conductivity etc. Finally, the presence of water can have a directing effect on certain reactions. A good example is the Diels Alder reaction of methyl acrylate and cyclopentadiene, in which both endo- and exo- isomers of the product are possible. The polarity of the solvent determines which is formed in the higher yield. Neat ionic liquids tend to form one isomer, whereas more polar solvents like water form the other one. Due to these differences, a person of skill in the art would not be motivated to use a Bratescu-type mixture in the same way an ionic liquid would be used, and would not be motivated to try to modify a Bratescu-type mixture in a way that would lead to the present invention.

(16) The discussion of Bratescu et al. in paragraphs (14) and (15) is quite consistent with the disclosure of the reference itself, e.g., at column 13, lines 25-65. This disclosure makes clear that it is necessary to include not only the cationic and auxiliary anionic surfactants, but also the anionic and bridging surfactants, so when the disclosed concentrate is diluted for use, all of the components remain in aqueous solution. This is quite different from the ionic liquids of my invention. Modifying the disclosure of Bratescu et al. to obtain an ionic liquid would be contrary to the explicit teachings of Bratescu et al. and would destroy the purpose of the Bratescu et al. invention.

(17) The ionic liquids of my invention are intended to be used with as little water as possible. The amount of water that is present is similar to an impurity, since all of the water is preferably removed from the ionic liquid.

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(18) As noted, the sulfosuccinate disclosed by Bratescu et al. is only one of a very large number of possible auxiliary anionic surfactants. From column 33, line 58 to column 35, line 63, Bratescu et al. discloses a great variety of anionic surfactants that might possibly be used, if one chooses to add an auxiliary surfactant to the otherwise disclosed mixture. There is nothing in Bratescu et al. that would guide the person of ordinary skill to select the sulfosuccinate specified by the structure (I) in the claims of the present application. And, as noted above, the amount disclosed would not be sufficient to form an ionic liquid.

I, Roger D. Moulton, hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with knowledge that willful false statements and the like are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued therefrom.

Respectfully submitted,

Roger D. Moulton9/28/06

Date